On the effect of space plasma upon the receiving characteristics of spacecraft antennas

M. Khodachenko(1), T.H. Oswald (1), W. Macher (1), H.O. Rucker

(1) Space Research Institute, Austrian Academy of Sciences, Graz, Austria (thomas.oswald@oeaw.ac.at)

Antennas and probes are widely used for in-situ measurements of electric field and plasma parameters in space, as well as for the communication and telemetry purposes. A number of missions such as Ulysses, Wind, Voyager, Cluster, Viking, Activny etc. have allowed space scientists to accumulate a large quantity of data using electric and magnetic antennas, operated in the passive or in the active regime. But the accurate interpretation of the measurements is difficult, due to the complicated behavior of antennas in space. Space conditions mean that the antennas are immersed in plasmas, and are generally not far from a spacecraft having a complicated shape. Using the methods of cumulant analysis, we develop theoretical approaches for generalization of the study of Maxwellian plasma dielectric and electromagnetic properties on the case of non-Maxwellian space plasmas with specific particle velocity distribution functions. These investigations are addressed further in the study of electromagnetic properties of antennas operating in space plasmas. Non-equilibrium particle distributions of the ambient plasma; its bulk motion and close location of the spacecraft body together with plasma resonances, temporal and spatial dispersion significantly change the amplitude-frequency characteristics of antenna impedance and influence the measured electromagnetic signals. An accurate account of all these processes appears in the main focus of the presented investigation.